

Epidemiology of Cancer

Introduction

Cancer is a big deal in the US. It's the number-two killer, just behind heart disease. The CDC's 2015 report on mortality rates lists heart disease as the cause of 633,842 deaths that year, with cancer responsible for 595,930 deaths. The problem is that "cancer" isn't a diagnosis. There are all sorts of cancers. And even cancers with the same name ("lung cancer" or even "squamous cell carcinoma of the lung") are different from person to person. This means that every cancer is different; but cumulatively, cancer is a major problem for our country. This lesson is filled with facts that should be memorized. Everyone cares about these numbers: patients, the test, the health care system, and the country as a whole.

Incidence and Mortality

All Causes of Mortality—Gender Agnostic	2015 CDC Data (Their Latest)
Heart disease (CHF, CAD)	633,842
Cancer	595,930
Chronic lower respiratory (COPD)	155,041
Stroke	140,323
Alzheimer's	110,561
Diabetes	79,535

Table 9.1: All Causes of Mortality

The top killers of Americans.

Most Common Cancers (US)		
Men	Advanced Organizer	Women
Skin	Skin	Skin
Prostate	[Gender-specific]	Breast
Lung	Lung	Lung
Colon	Colon	Colon

Table 9.2: Cancer Prevalence

Ranking, in order, of the most common cancers in Americans.

Most Common Cancer Killers (US)		
Men	Advanced Organizer	Women
	“Lung jumps gender-specific”	
Lung	Lung	Lung
Prostate	[Gender-Specific]	Breast
Colon	Colon	Colon

Table 9.3: Cancer Mortality

Ranking, in order, of the most common cancer killers in the United States.

Metastasis

Metastasis Most Common	
To Brain:	Lung > Breast > Melanoma
To Liver:	Colon >> Stomach, Pancreas
To Bone:	Prostate / Breast > Lung / Thyroid / Renal cell (Blastic) (Mixed) (Lytic)

Table 9.4: Metastasis

Based on where a metastatic lesion is found, link it to the most likely source.

Metastatic sites are often opportunistic—they simply end up where they end up based on geography or blood flow. The lungs are the most common site of metastasis because **all of the blood, the entire cardiac output**, goes through the lungs. Capillaries are too small for RBCs to fit through without deforming. A single cancer cell could simply get caught in the capillary net and set up shop. Another example is the colon. The colon drains **all of the mesenteric veins**, a process called **portal circulation**. The lymph nodes are all mesenteric. It makes sense that the GI organs, which produce GI cancers, would end up in the exit of the portal system—the liver—which is why colon, stomach, and pancreatic cancers are present in the liver.

Brain tumors do not metastasize. By the time they would be developed enough to metastasize, the space-occupying lesion would be so great that the brain would have been consumed or herniated. However, other cancers will metastasize to the brain. Cancers that have a predisposition for the brain are **lung, breast, and melanoma**. Brain metastases are often visualized stuck at the **grey-white junction**. A primary brain lesion is a single lesion (brain cancers don't metastasize). Multiple lesions, especially at the grey white junction, is a metastasis to the brain.

Keeping the Nomenclature Straight 90% of the Time

Cancer Types With Some Examples			
Carcinoma	Sarcoma	Lymphoma	Leukemia
Squamous cell carcinoma	Ewing's sarcoma (bone)	Hodgkin's lymphoma	AML
Adenocarcinoma of lung	Rhabdomyosarcoma	Non-Hodgkin's lymphoma	ALL
Colon cancer	Leiomyosarcoma		CML
Breast cancer	Liposarcoma		CLL
Prostate cancer	Angiosarcoma		

Table 9.5: Cancer Types

There are four main cancer types, and each has many examples. Carcinoma (epithelial layers), sarcoma (mesenchyme), lymphoma (lymph nodes), and leukemia (bone marrow).

Carcinoma implies epithelial origin. All tissues have an epithelium, a lining, as discussed in Gen Phys #9 *Epithelium*. **Carcinoma means anything not sarcoma and not hematopoietic and not germinoma.** Think of carcinoma as the default cancer type. Carcinomas usually spread lymphatically, except for renal cell, hepatocellular, thyroid follicular, and choriocarcinoma, which spread hematogenously.

Sarcomas come from mesenchymal tissue. Mesenchyme refers to the cells of **blood vessels, lymphatics** (but not nodes), and all of the musculoskeletal system—**bones, ligaments, muscles, and joints**.

Sarcomas typically spread **hematogenously**. I tend to think of sarcomas as the “stuff of extremities” as a simple way to lump them together—excluding lymph nodes and nerves.

Hematopoietic cells derived from the bone marrow have special names. There are no malignancies of red blood cells or platelets (they don't have nuclei), so malignancies are only of white cells. White blood cell cancers that come from the marrow and are in the blood are called **leukemia** (leuk=white; emia-in blood). White blood cell cancers that come from lymph nodes are cancers of lymphocytes, and are called **lymphomas** (lymph-lymphocyte/lymph node; oma- growth).

Germ cells are called **germinomas**.

Source	Benign	Malignant
Epithelium	Adenoma	Adenocarcinoma
	Papilloma	Papillary carcinoma
	Leiomyoma	Leiomyosarcoma
Mesenchyme	Lipoma	Liposarcoma
	Angioma	Angiosarcoma
Lymphocyte	Germinal centers	Lymphoma, leukemia ← exception!
Melanocyte	Nevus (mole)	Melanoma

Table 9.6: Benign vs. Malignant

Nomenclature can be tricky. Often the benign and malignant form of a growth of a cell type is safely stored in the word itself. There are exceptions, however, such as lymphoma, leukemia, and melanoma.

Screening and Prevention

Cancer	Screening	Prevention
Lung	Low-dose CT q1y 55-85 years old ≥ 30 packs/year or more < 15 years from last smoke	Smoking Cessation Screen and early detection <i>Catch early cancer</i>
Colon	Start 50 yo or 10 yrs before fam member Colonoscopy q10y or Flex sig q5 + FOBT q3y or FOBT q1y	↓ Red meat (probably processed meat) Screen and early detection <i>Catch early cancer</i>
Breast	Can start 40 yo with q1y or q2y mammogram but... Start 50 yo q2y mammogram is minimum recommend AGAINST breast exam (hands)	Screen and early detection (risk factors discussed elsewhere) <i>Catch early cancer</i>
Cervical	Start 21 yo q3y pap then Start 30 yo q5y pap + HPV	Vaccinate against HPV Screen and early detection <i>Catch pre-cancer (dysplasia)</i>
Prostate	DON'T SCREEN unless AA + 1 st -degree fam dx at < 65, DRE + PSA	N/A
Skin	Routine surveillance (look at self)	Avoid UV Radiation / Sunscreen
HCC In special Populations	U/S and AFP q6months if HepB, cirrhosis + HIV U/S and AFP q1y if cirrhosis, HepC	Limit alcohol Vaccinate HepB Treat HepC
Ovarian	NONE	NONE
Testicular	NONE	NONE
Pancreatic	NONE	NONE
Leukemia	NONE	NONE
Lymphoma	NONE	NONE
Renal cell	NONE	NONE
Thyroid	NONE	NONE

Table 9.7: Screening and Prevention

Knowing which cancers DON'T get screened is as important as which cancers DO get screened and what the options for screening are.

Screening has a definite **start date**—screening for each cancer begins at a certain age. **Screening stops** under special circumstances. Cessation of screening is based on evidence (sort of), but more on **risk-benefit analysis**. An 88-year-old bed-bound nursing-home patient likely does not benefit from the 10-year mortality benefit of another colon cancer screen. In this example, the risk of colonoscopy exceeds the benefit. But at the same time, an 82-year-old man running marathons should probably get that colonoscopy. Right now, don't worry about stop dates. Focus more on the **start age** and the **route of screen**. We include only common cancers and screening recommendations for the general population. BRCA1/2, for example, gets more aggressive breast cancer screening, and patients with ulcerative colitis start colonoscopies 8 years after diagnosis. Don't learn the exceptions here.

General health and well-being help reduce cancer risks also—**eat right** (organic foods, portion control, as whole-food-plant-based as possible), **exercise**, **BMI < 25**, and then **don't smoke, don't drink** (“*that's why I don't be by the bar, baby*”).

But the table above suggests that “prevention” really means “risk reduction” and “early detection.” Except for HPV vaccination, which truly can vaccinate against cervical cancer, anything we do simply reduces the risk of developing malignancy. If we are able to screen for cancer, we can **detect it early**, and **remove the cancer** before it transforms into malignancy.

Vignette Clue	Most Common Cancer Type	Mechanism
Japanese, Japan	Gastric cancer	Nitrosamines in packaged food
Southeast Asia	Hepatocellular carcinoma	Hep B vertical transmission and cross-contamination of nursery
Shipyards, construction, or pleural plaques	Bronchogenic lung cancer (more than mesothelioma)	Asbestos exposure
Dry cleaning	Bladder	Aromatic amines
Radiation exposure	Thyroid	Radiation is bad
Sun-worshipper, farmer, sailor, tanning beds, bad sunburns, freckles, fair-skin, red-hair	Skin, but could be squamous, basal, or melanoma	UV radiation (UVB & UVA)
Radiation for another cancer	Lymphoma	Side effect of radiation
Sandblasting, aeronautics	Lung cancer	Occupational exposure to particulate matter inhaled into lungs

Table 9.8: Test-Taking Giveaways
Uh...I mean...“carcinogens” or “risk factors.”

Virus	Cancer	Virus	Cancer
HPV	Squamous cell of anus, cervix, vagina, larynx. Where semen goes, HPV goes, and cancer can develop	EBV	Burkitt's lymphoma
Hep B	Hepatocellular carcinoma	HHV-8	Kaposi's sarcoma
Hep C + cirrhosis	Hepatocellular carcinoma	HTLV-1	T-cell leukemia rarely seen in life, common on test

Table 9.9: Viruses Causing Cancer